

## **Appendix A**

### **Elemental Analyses and Soluble Soil Cations of Six Uncontaminated RWMC Soil Samples**



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### Elemental Analyses and Soluble Soil Cations of Six Uncontaminated RWMC Soil Samples

The tables presented here represent the unique general chemistry and mineralogy of the Idaho National Laboratory surficial sediments at the Radioactive Waste Management Complex (RWMC). Table A-1 identifies the wt % elemental analyses shown as the most common oxide of RWMC soil samples (Miller, Castle, and Smith 2001). Table A-2 illustrates the soluble soil cations present in the RWMC surficial sediments (Miller, Castle, and Smith 2001).

Table A-1. Elemental analysis of major rock-forming minerals.

Calculated as wt% most common oxide	<u>Si</u>	<u>Fe</u>	<u>Mg</u>	<u>Mn</u>	<u>Cu</u>	<u>Cr</u>	<u>Ti</u>	<u>Al</u>	<u>Sr</u>	<u>Ca</u>	<u>Na</u>	<u>K</u>
RWMC Sample 1	34.6	2.93	2.86	0.089	0.019	0.011	0.40	5.87	0.0051	0.88	0.7	2.5
RWMC Sample 2	32.7	2.67	2.50	0.11	0.060	0.014	0.47	5.85	0.0063	0.77	0.9	2.6
RWMC Sample 3	31.8	4.71	5.34	0.19	0.042	0.015	0.64	6.90	0.0064	1.54	0.9	2.0
RWMC Sample 4	34.1	2.40	2.73	0.037	0.055	0.011	0.41	5.73	0.0064	0.88	0.9	2.2
RWMC Sample 5	30.5	2.79	3.14	0.057	0.023	0.0098	0.41	5.88	0.0076	2.02	0.8	2.1
RWMC Sample 6	28.1	1.93	3.48	0.041	0.039	0.0074	0.33	4.54	0.0095	5.73	0.9	2.0
Spreading Area B Soil	34.0	2.19	3.02	0.034	0.024	0.0069	0.356	5.04	0.0075	2.98	0.80	1.8

RWMC soil samples described in Tables A-1 and A-2 were acquired at the 1- to 18-ft depth from the Cold Test Pit North. The test pit is just outside the Subsurface Disposal Area fence near Pad A. Spreading Area B soil was acquired from a 1-ft depth.

Table A-2. Soluble soil cations.

ppm/g soil	<u>Ca</u>	<u>K</u>	<u>Na</u>	<u>Mg</u>	<u>Al</u>	<u>Ti</u>	<u>Mn</u>	<u>Zr</u>	<u>Si</u>	<u>Fe</u>	<u>Cu</u>	<u>Ni</u>	<u>Cs</u>	<u>Ba</u>
RWMC Sample 1	205	12	18	19	0.57	0.006	0.008	<0.01	3.6	<0.05	<0.05	<0.1	63	210
RWMC Sample 2	143	16	11	28	0.48	0.012	0.003	<0.01	3.6	<0.05	<0.05	<0.1	65	199
RWMC Sample 3	124	18	20	32	0.38	0	0.002	<0.01	<0.1	<0.05	<0.05	<0.1	80	188
RWMC Sample 4	200	11	15	29	1.5	0.036	0.004	<0.01	3.8	<0.05	<0.05	<0.1	95	182
RWMC Sample 5	270	10	3	36	0.78	0	0.001	<0.01	5.1	<0.05	<0.05	<0.1	70	197
RWMC Sample 6	238	5	1	10	760	0.001	0.006	<0.01	1.1	<0.05	<0.05	<0.1	100	241
Spreading Area B Soil	285	14	2	28	0.99	0.016	0.011	<0.01	3.5	<0.05	<0.05	<0.1	95	227

## **A-1. References**

Miller, David L., Peter M. Castle, and Robert W. Smith, 2001, *Environmental Systems Research FY 2000 Annual Report*, INEEL/EXT-2000-01085, Idaho National Laboratory.

**Appendix B**

**Field Observations Sampling Guidance**



## Appendix B

### Field Observations Sampling Guidance

The information in this appendix is condensed from the remedial action report for the Glovebox Excavator Method Project; for the detailed description of the remedial action and operation activities see *Remedial Action Report for the OU 7-10 Glovebox Excavator Method Project* (DOE-ID 2004).

#### B-1. SUMMARY OF EXCAVATION

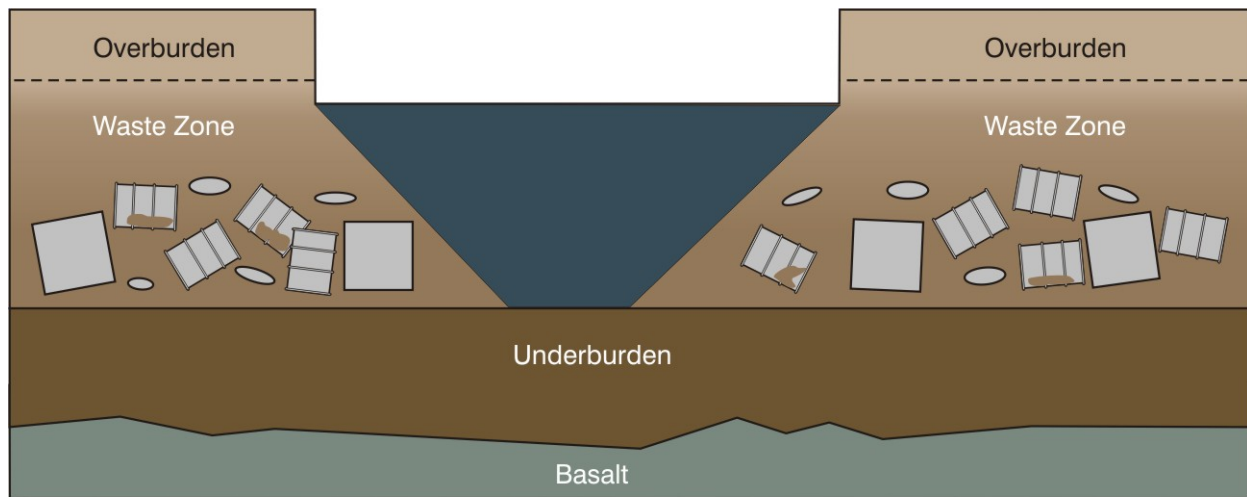
The charter of the Glovebox Excavator Method Project was to demonstrate retrieval, characterization, and interim storage of transuranic waste from a selected part of Operable Unit (OU) 7-10. The selected area was part of Pit 9 in the Subsurface Disposal Area, which is within the Radioactive Waste Management Complex (RWMC). The retrieval demonstration area was selected by representatives from the U.S. Department of Energy (DOE), the State of Idaho Department of Environmental Quality, and the U.S. Environmental Protection Agency. The area is defined as a fan-shaped plot with a 6 m (20 ft) radius and an angular extent of 145 degrees. The retrieval demonstration area was primarily that region located within the larger 12.2 m × 12.2 m (40 ft × 40 ft) area of interest investigated during Stage I of the OU 7-10 Staged Interim Action Project.

Overburden removal—started on December 12, 2003—involved excavation of approximately 1.1 m (3.5 ft) of soil from the excavation area in the Retrieval Confinement Structure (RCS) using the excavator. Overburden material was placed into soil sacks designed to hold up to 1.8 m<sup>3</sup> (64 ft<sup>3</sup>) of material. Operations personnel also entered the RCS and used shovels to manually remove overburden soil from around the P9-20 probe cluster. Approximately 57 m<sup>3</sup> (2,000 ft<sup>3</sup>) of overburden was removed from the excavation site (39 sacks × 0.8 × 1.8 m<sup>3</sup> [64 ft<sup>3</sup>] per sack). Completion of overburden removal occurred on December 19, 2003. Soil from across the excavation area was then removed to a depth of 1.1 m (3.5 ft) below ground surface after removal of overburden. Personnel entered the RCS following removal of targeted overburden and cleaned and removed unnecessary equipment in preparation for waste retrieval operations.

Activities for removal of waste zone material began on January 5, 2004. Waste retrieval operations commenced following receipt of concurrence to proceed from the DOE Idaho Operations Office. As expected, excavator operators removed only soil from the excavation site at first. Waste was not encountered until approximately 1.8 m (6 ft) of soil had been removed. Figure B-1 depicts the location of the overburden, waste zone, and underburden regions of the recent excavation at Pit 9.

#### B-2. SAMPLE COLLECTION

Sludge and interstitial soil samples in support of the OU 7–13/14 Retrieved Waste and Soil Characterization (RWSC) Project were collected from the active waste zone. Twenty soil samples acquired by the OU 7–10 project from the upper portion of the waste zone before excavation of any waste were also requested, received, and analyzed by the RWSC Project. Those samples comprised either clean overburden or clean backfill soil and were used as blank soils for comparison purposes. Radionuclides in those samples were found to exist at or below commonly found background levels for typical Idaho National Laboratory soils, thus the samples were deemed to be suitable for use as benchmark soils (i.e., blanks or baseline soils). Blank soils previously obtained from the Cold Test Pit North and Spreading Area B were also used as references primarily because those soils had been studied and were well characterized and previously reported in peer-reviewed scientific literature.



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Figure B-1. Cross section of Pit 9 showing the various layers of overburden, waste zone, underburden, and basalt encountered during excavation (DOE-ID 2004).

During operations, the excavator operator used the excavator bucket to acquire scoops of waste zone materials, then placed those materials in transfer carts at one of three gloveboxes. Each transfer cart was lined with a fresh soil bag to prevent cross contamination from previous scoops. When the operator acquired a scoop of waste zone material (i.e., waste and soil excavated from below the overburden depth of 1.1 m [3.5 ft] below ground surface), a scoop/cart number was assigned based on the packaging glovebox where the scoop was placed. For example, scoop/cart number 3004 would be the fourth scoop of material placed into glovebox line #3. The scoop/cart numbers were assigned sequentially as a function of the Packaging Glovebox System (PGS) in which the scoop was placed.

When the operator took a scoop of waste zone material, the location coordinates of reach, angle, and depth were recorded. Figure B-2 depicts the fan-shaped excavation area from which reach and angle coordinates were obtained. Reach was the distance from the excavator pivot point (zero) and the excavator bucket at the time the scoop was taken. Angle was measured in tens of degrees, where zero degrees was to the right and perpendicular to the excavator (i.e., the southwest corner of the excavation area). Depth was measured relative to the excavator pivot point, which was approximately 1.2 m (4 ft) above the initial overburden surface (or approximately 2.3 m [7.5 ft] above the top of the waste zone). Depth measurements were provided from a depth monitor mounted on the excavator bucket. This information was recorded by operators on RWMC Form-300 (see Appendix D in DOE-ID 2004) for each scoop acquired.

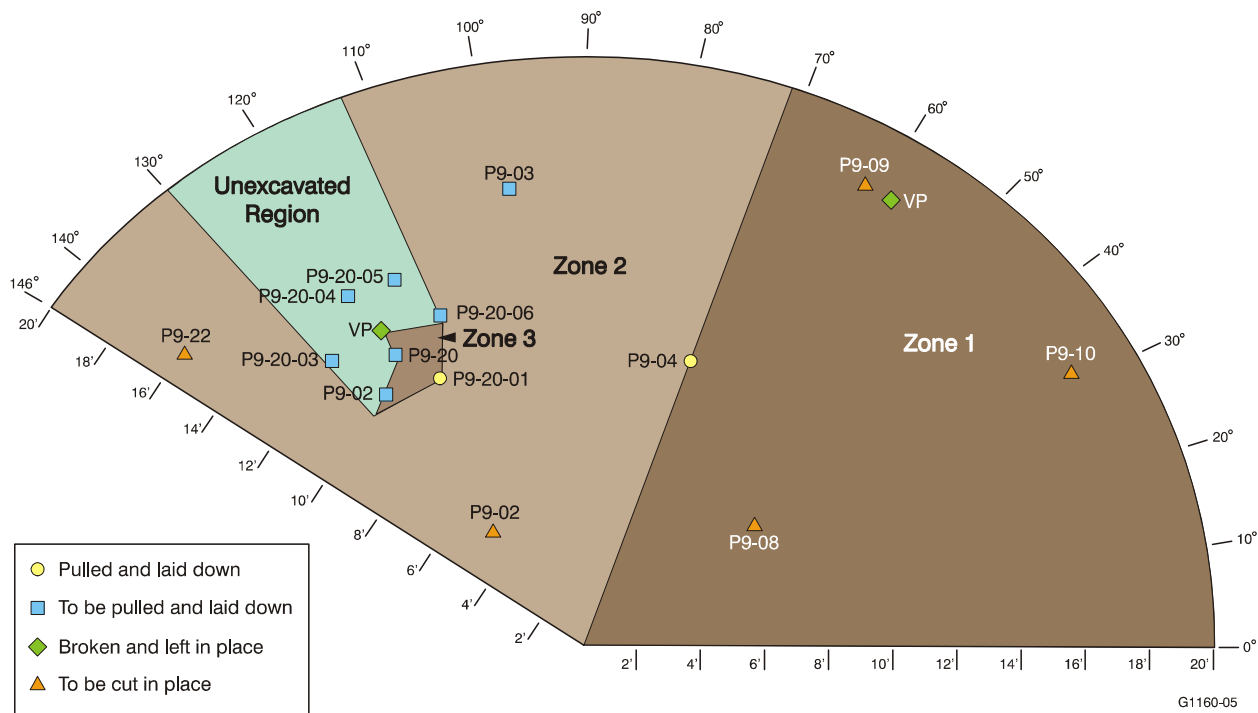


Figure B-2. Fan-shaped excavation area showing the location of probes (DOE-ID 2004).

Once a scoop of waste was placed into a PGS transfer cart and the waste was brought into the glovebox by the PGS operators, the waste was visually evaluated to identify the general waste types that made up the cart load (i.e., soil, sludge, debris, or miscellaneous). Waste types were broken down further by attempting to identify the types of sludges (e.g., Series 741 through 745), debris (e.g., graphite or plastics), or miscellaneous item(s) (e.g., nitrates or high-efficiency particulate air filter material) present in the scoop. That waste information was recorded by checking applicable boxes on RWMC Form-300. When waste types were visually identified that potentially contained fissile material, those materials were placed into a separate bucket and measured for fissile content in the fissile materials monitor. The resulting fissile gram equivalent measurement for the waste was then recorded on RWMC Form-300. When PGS operators were ready to remove waste from the transfer cart, the soil bag was closed, then lowered by hoist into a new drum. The drum port number and the drum barcode (indicating where the waste was placed) were recorded on the RWMC Form-300.

Samples of waste zone solids were acquired from the PGS carts during glovebox activities as required by *Field Sampling Plan for the OU 7-10 Glovebox Excavator Method Project* (Salomon et al. 2003) and as prescribed by *Data Quality Objectives for the OU 7-10 Glovebox Excavator Method Project* (McIlwain 2003). Samples were collected in clean, 250-mL Wheaton jars. When samples were acquired from the transfer carts, fresh spatulas were used to fill the 250-mL sample jars. Samples to support the various OU 7-13/14 projects were included in the samples taken from the transfer carts. Samples for OU 7-13/14 of waste zone solids were acquired in a biased manner and were tracked using RWMC Form-298 after collection (see Appendix D in DOE-ID 2004). After samples were acquired, the contents of the transfer cart were processed in the manner prescribed by the *Run Plan for the OU 7-10 Glovebox Excavator Method Project* (PLN-1365).

Field representatives from OU 7-13/14 supported documentation of daily operations including identification of waste forms, identification of biased sampling opportunities for OU 7-13/14, identification of underburden core locations, recording conditions of the buried waste, and collecting

other information/observations to support evaluation of remedial alternatives for OU 7-13/14. That information was recorded in the field representative logbooks maintained in the OU 7-13/14 Project File. Field representatives were provided training in waste form identification and aided in development of sampling criteria for biased sampling of waste zone materials in support of OU 7-13/14 projects. Field representatives familiarized themselves with Glovebox Excavator Method Project operations and frequently interfaced with operations crews very early during facilities systems operability tests and excavation startup activities.

Field representatives were present during the excavation; samples of waste zone solids were acquired when the excavator operator encountered an identifiable candidate waste form (i.e., sludge, graphite, or debris), which the field representatives judged to be of interest. When such a sampling opportunity presented itself, field representatives consulted with the shift supervisor and sampling of the targeted materials in the PGS cart occurred if feasible. In some instances, through cooperation between the shift supervisor and the excavator heavy equipment operator, selected parts of the waste zone were acquired and placed into the PGS cart for OU 7-13/14 sampling. Once in the PGS, through additional cooperation between the shift supervisor and the PGS crew foreman, materials in the PGS cart were then carefully sampled. Field representatives recorded observations and data related to the excavation operations in logbooks (Olson 2004a, 2004b). Sampling activities and detailed sample descriptions were also recorded on a Sample Information Sheet which is also kept in the logbooks (Olson 2004a, 2004b). Data recorded on the Sample Information Sheets was as follows:

- Sample number
- Sample type (e.g., inorganic, organic, interstitial soil)
- OU 7- 13/14 subproject supported
- Glovebox line number
- Date, time (24 hour), sample weight, radiation reading
- DDTC number
- New drum bar code
- Location (reach, angle, depth)
- Scoop number
- Justification for soil sample
- Description of waste materials in cart
- Sample characteristics
- Description of dig face.

Data related to sample descriptions and characteristics included further information such as condition of items, identifiable materials, presence of liquids, moisture, color, texture, etc. Field representative logbooks (Olson 2004a, 2004b) are maintained in the OU 7-13/14 Project File.

### B-3. FIELD CHARACTERIZATION OF SAMPLES

Selection criteria for OU 7-13/14 samples were developed by various OU 7-13/14 staff with input from field representatives, subject matter experts, and technical staff from the various OU 7-13/14 subprojects for which the samples were being collected. Biased grab samples of waste zone solids were acquired based on those sampling criteria, best judgment, and the conditions that existed at the time a sampling opportunity arose. Some of the criteria for acquiring samples of waste zone solids were rather broad, and an additional degree of difficulty and uncertainty were introduced by the excavator method for collecting sludge and interstitial soil samples in support of the RWSC Project. Ideal sludge samples for the RWSC Project were envisioned as those containing measurable levels of various contaminants of concern. Ideal sludge samples were envisioned as having no cross-contamination with soil or water, neither historically after having been interred in the ground for more than 30 years nor incidentally as a result of being collected by the excavator and dumped into the PGS cart. Although historically cross-contaminated (with soil and water) sludge samples would have provided some data useful for scientific pursuits, the purpose for acquiring a so-called “fresh” sludge sample was to acquire actinide content, concentration, and solubility data without contribution from an external source.

The probability of incidental surface cross contamination from the excavator itself was high because the excavator bucket was never cleaned between scoops. Further, materials from a higher elevation in the waste zone would frequently roll downhill from the dig face, potentially imparting surface cross-contamination to materials below it. In several instances during the excavation effort, fine powdery drum contents were either intentionally or unintentionally released and dispersed throughout the containment structure, covering practically all surfaces exposed at that time. Even though sampling conditions for sludge were less than ideal, it was quite possible to continually uncover new materials and collect large scoops of intact sludge from which samples free of dirt could be acquired. Intact and pliable plastic drum liners were frequently encountered in the upper waste zone even though the steel drums were severely corroded. Relatively “fresh” sludge, still possessing an organic “wet” sheen, was encountered and suitable samples free of soil were acquired. Some sludge samples collected from deeper in the waste zone were observed to be saturated with water from historical cross-contamination because plastic drum liners were often compromised and brittle due to long exposure to soil and water.

Similar difficulty and uncertainty were introduced in the collection of interstitial soil samples for the RWSC Project. Ideal soil samples were envisioned as those that were historically intact (i.e., “as is” from the time of drum emplacement and backfilling) without significant incidental surface cross-contamination resulting from excavation events. Even though the probability of incidental surface cross-contamination to soil samples was high due to excavation methods, new soils were continuously being uncovered and in several fortunate instances large chunks of intact soil and previously undisturbed soils (since the time of drum emplacement) were encountered, carefully selected for excavation, placed into a fresh transfer cart liner (i.e., soil bag), then sampled using clean spatulas. In some cases, intact soil chunks were carefully broken open in the PGS line and the internal surfaces were sampled. However, not all sludge or soil samples collected were ideal; therefore, laboratory data, first-hand visual observations obtained by the field representative on shift at the time of sample collection, photographic examination, and subsampling visual inspection data should all be carefully reviewed in concert for each sample.

## **B-4. REFERENCES**

- DOE-ID, 2004, *Remedial Action Report for the OU 7-10 Glovebox Excavator Method Project*, DOE/NE-ID-11155, Rev. 0, U.S. Department of Energy Idaho Operations Office.
- McIlwain, Beth A., 2003, *Data Quality Objectives for the OU 7-10 Glovebox Excavator Method Project*, INEEL/EXT-02-00660, Rev. 2, Idaho National Laboratory.
- Olson, Gail, 2004a, *OU 7-13/14 Field Representative GEM Logbook-Glovebox Book*, ER-038-2004, Rev. 0, Idaho National Laboratory, January 20, 2004 - February 20, 2004.
- Olson, Gail, 2004b, *OU 7-13/14 Field Representative GEM Logbook-Excavator Book*, ER-039-2004, Rev. 0, Idaho National Laboratory, December 15, 2003 - February 24, 2004.
- PLN-1365, 2004, "Run Plan for the OU 7-10 Glovebox Excavator Method Project," Rev. 3, Idaho National Laboratory.
- Salomon, Hopi, Daryl R. Haefner, Beth A. McIlwain, Jila Banaee, Jeffrey J. Einerson, and Anna K. Podgorney, 2003, *Field Sampling Plan for the OU 7-10 Glovebox Excavator Method Project*, INEEL/EXT-02-00542, Rev. 2, Idaho National Laboratory.